

- (57) A gripping device includes an actuating piston (15), and gripping arms (5, 6) which can be made to closely surround a workpiece (1) but leave a clearance (31) between the gripping jaws (7, 8) and the workpiece. An adjustable stop means (17) engaging a first piston (19) sets this clearance. The final clamping movement of the jaws arises when a second piston (18) is urged to the left causing the piston rod (15) to slide within the first piston (19).

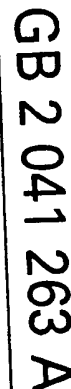


Fig. 1

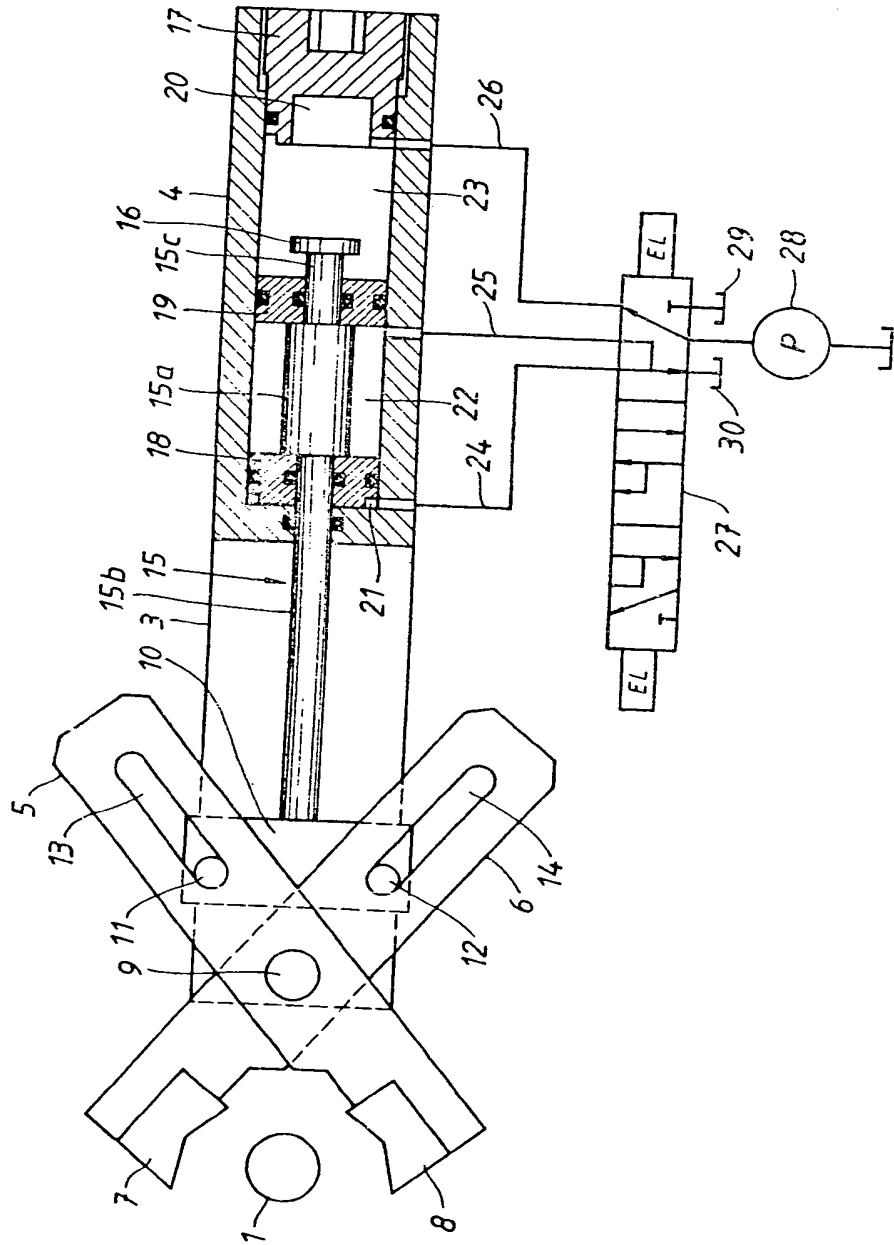
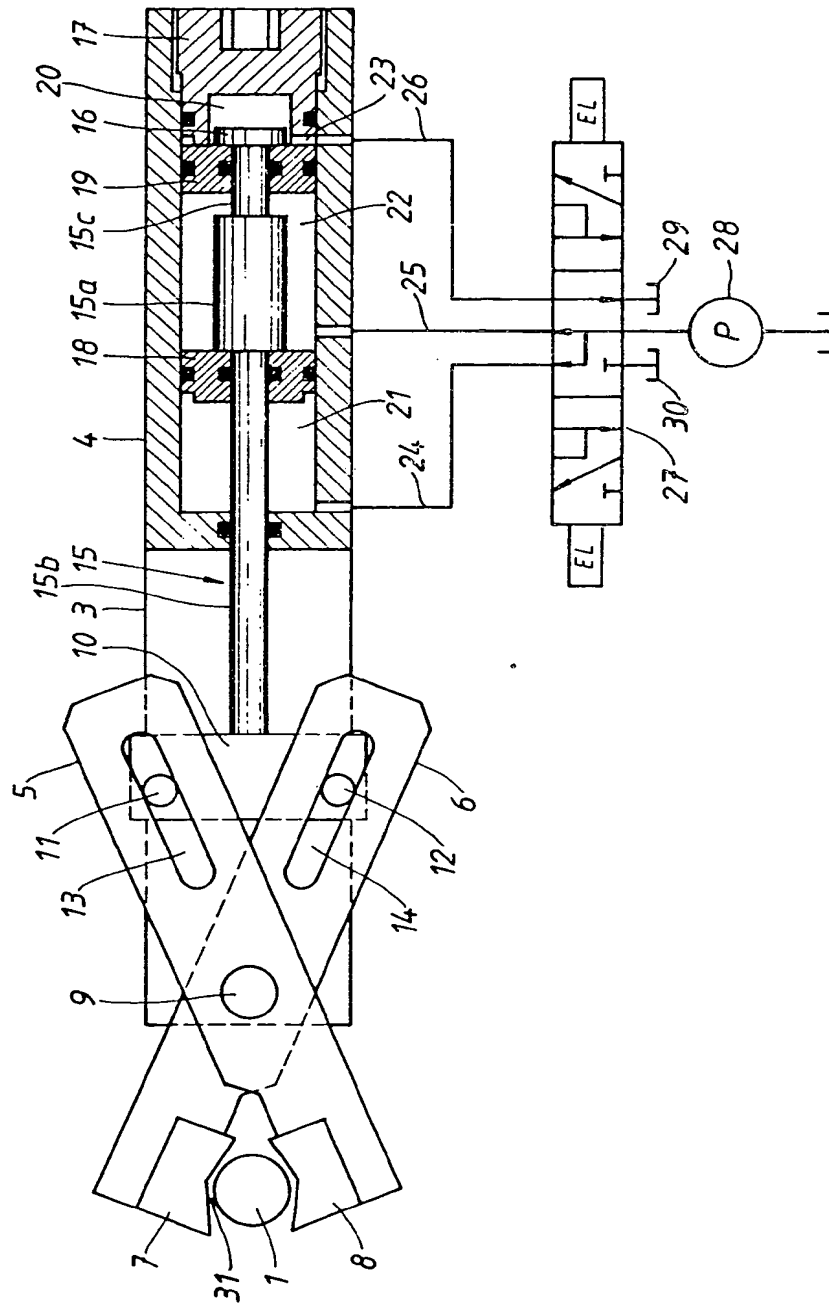


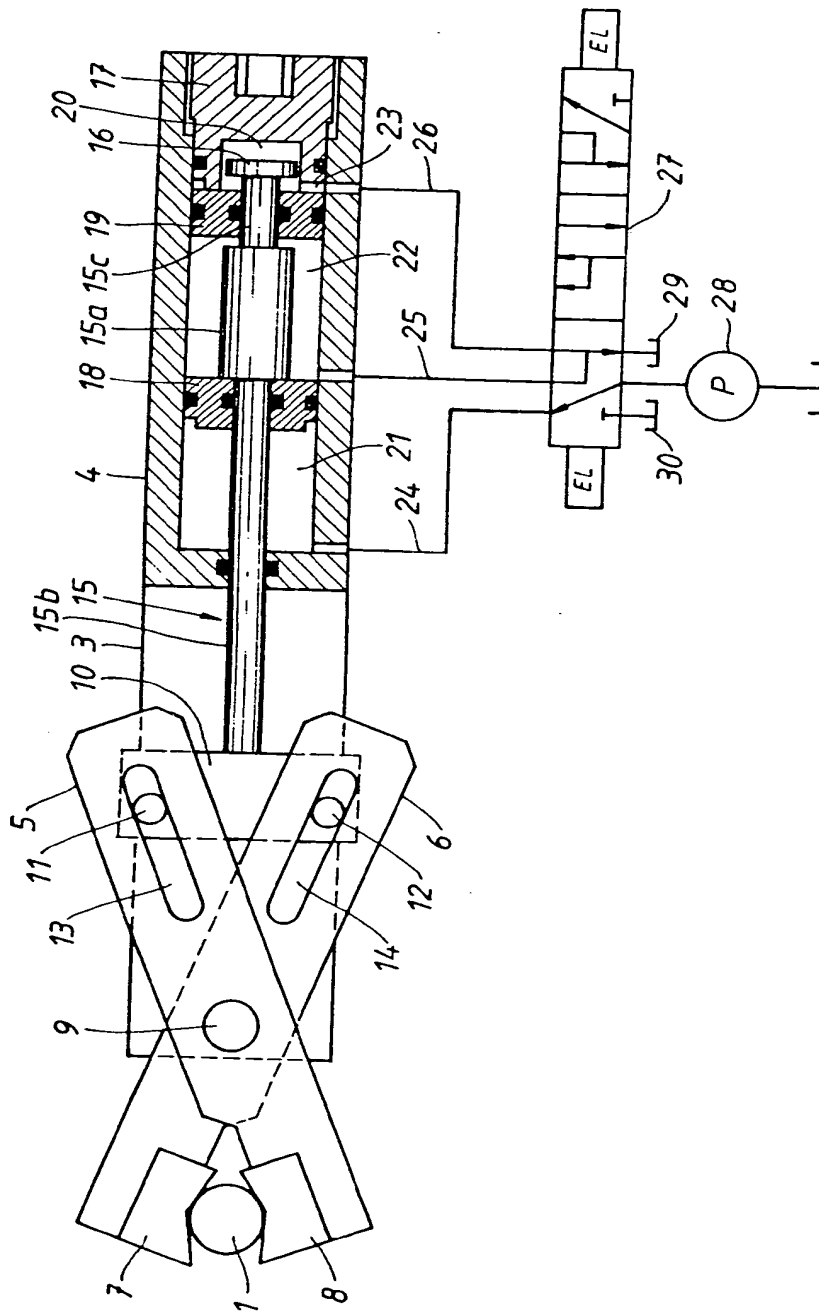
Fig. 2



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Fig. 3



SPECIFICATION

Gripping device for moving workpieces relative to a machine tool

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The present invention relates to a gripping device for transporting workpieces to or from a machine tool. It is particularly intended for picking up and removing long parts from an automatic lathe operating on bar stock, in which the turned parts need to be supported when being cut off in order to prevent their being broken off from the bar stock by their own weight or by the automatic cutter before the cutting tool has reached the centre of rotation of the turned part. The gripping device can be supported by a transport arm in the machine or by a manipulating robot. The gripping device may have jaws rectilinearly movable one with respect to the other or the jaws can be turnably mounted one relative to the other (i.e. a gripping device of the "tongs type") e.g. with a yoke coupled to the arms, said yoke upon a rectilinear motion, effecting a swinging movement of the arms so that the jaws will close around a workpiece.

According to the invention, there is provided a gripping device having relatively movable gripping arms for transporting workpieces to or from a machine tool, said device having a yoke connected to the arms of the gripping device, said yoke upon a rectilinear movement effecting a gripping movement of the arms of the gripping device, which is characterised in that the gripping movement of the gripping device is effected by an operating cylinder having a first and a second piston in a common cylinder housing and actuating a common piston rod connected to the yoke, the first piston being arranged to be movable to a limited extent on the piston rod and displaceable to a limited extent within the cylinder housing, the second piston being arranged to apply a tensile force to the piston rod, and therefore the yoke, and thus displace the yoke in the direction to further close the gripping arms together, after the movement of the first piston has been arrested by a stop means.

The stop means may consist of a plug which may be screwed by a pre-set amount into the end of the cylinder housing. The second piston may be fixedly or movably arranged on the piston rod.

Through the invention a two step movement of the arms of the gripping device is obtained by means of one single operating cylinder which can have very small outer dimensions. In automatic lathes a compact design is of very great value because of the very restricted space available. The gripping jaws are first brought to a supporting position with a clearance to the workpiece in the machine so that the workpiece may rotate without obstruction during a cutting-off operation, while simultaneously enjoying a good support during the cutting-off. Particularly in the case of long workpieces this supporting function is of real value. After the cutting-off, the jaws are brought to a gripping position where the workpiece is firmly clamped between the jaws.

The invention will be described, in more detail, by way of example, with reference to the accompanying

drawings, in which the gripping arms of a gripping device in accordance with the invention are shown in their three possible positions.

Figure 1 shows the position of the arms when the gripping device is inserted into a machine for picking up a finished part,

Figure 2 shows the arms with the jaws in an intermediate supporting position, and

Figure 3 shows the arms with the jaws in the final gripping or holding position.

In the Figures, 1 designates (in cross-section) a workpiece in a lathe (not shown). A gripping device 2 is attached to an operating arm of the lathe or of a manipulating robot. The gripping device includes a supporting plate 3, an operating cylinder 4, gripping arms 5 and 6 with jaws 7 and 8 adapted to the size of the workpiece 1 and a yoke 10, displaceable by the operating cylinder 4, which upon its movement causes a turning of the arms 5 and 6 about a shaft pivot 9 supported by the plate 3. The yoke 10 coacts with the plate so that the latter controls its motion. The yoke 10 is provided with pins 11 and 12 located in slots 13 and 14 in the arms 5 and 6.

A piston rod 15 is attached to the yoke 10 and is formed with an intermediate portion 15a having a larger diameter than the outer portions 15b and 15c. A screw 16 with a head which has a diameter larger than the diameter of the rod portion 15c, is screwed into the inner end of the piston rod. A plug 17 is screwed into the end of the cylinder 4. The housing of the cylinder 4 includes a first piston 18 which is movable along the piston portion 15b. The piston 18 may be fixedly arranged on this part. There is further a second piston 19 which is axially movably arranged on the piston rod portion 15c between the piston rod portion 15a and the head of the screw 16. The plug 17 forms an adjustable stop means for the piston 19. The plug 17 contains a recess 20 for the piston rod portion 15c and the head of the screw 16. Spaces 21, 22 and 23 in the cylinder 4 communicate with a pressure medium source 28 through conduits 24, 25 and 26 via a valve 27.

Figure 1 shows the gripping device in an open position inserted into a machine tool. The spaces 21 and 22 communicate with a reservoir 30 and the space 23 communicates with the pressure medium source 28, through the valve 27. The piston 19 urges the piston rod 15 and the yoke 10 to the left with a force which holds the gripping arms 5 and 6 in the open position shown.

By a first adjustment of the valve 27 to the position shown in Figure 2, the spaces 21 and 22 are put into communication with the pressure medium source 28 and the space 23 is put into communication with a reservoir 29. The piston 19 is now displaced to the right by the pressure medium. First it is displaced along the piston rod portion 15c until it makes contact with the head of the screw 16. Thereafter it pulls the piston rod 15 and the yoke 10 to the right, until the movement of the piston 19 is stopped by the plug 17. The pins 11 and 12 force the arms 5 and 6 to turn about the pivot 9. The plug is adjusted in the cylinder 4 into such a position that a clearance 31 is obtained between the jaw 7 and the workpiece such that the workpiece may freely rotate but at the same

time be supported, against any major transverse movement, by the jaws 7 and 8. The fluid pressure in the spaces 21 and 22 is equal, and therefore the piston 18 cannot influence the piston rod 15 with any axially directed force.

- 5 By a second adjustment of the valve 27 into the position shown in Figure 3, the space 22 is put into connection with the reservoir 29. The piston 18 will now influence the piston rod 15 with a force directed to the right, resulting in the piston rod 15 and the yoke 10 being displaced further to the right, the workpiece 1 thus being clamped between the jaws 7 and 8 and being safely retained by the gripping device while the workpiece is transferred to a collecting station for machined parts or to another machine tool for further machining. This subsequent movement of the piston rod 15 by means of the piston 18 is made possible because the piston 19 is displaceably arranged on the piston rod portion 15c.

20 CLAIMS

1. A gripping device having relatively movable gripping arms for transporting workpieces to or from a machine tool, said device having a yoke connected to the arms of the gripping device, said yoke upon a rectilinear movement effecting a gripping movement of the arms of the gripping device, characterised in that the gripping movement of the gripping device is effected by an operating cylinder having a first and a second piston in a common cylinder housing and actuating a common piston rod connected to the yoke, the first piston being arranged to be movable to a limited extent on the piston rod and displaceable to a limited extent within the cylinder housing, the second piston being arranged to apply a tensile force to the piston rod, and therefore the yoke, and thus displace the yoke in the direction to further close the gripping arms together, after the movement of the first piston has been arrested by a stop means.
2. A gripping device according to claim 1, in which the adjustable stop means consists of a plug screwable into an end of the cylinder housing.
3. A gripping device as claimed in claim 1 or claim 2, in which the gripping arms are of the tongs type and are turnably mounted one relative to the other and each make sliding contact with the yoke.
4. A gripping device substantially as hereinbefore described with reference to the accompanying drawings.

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